

supporters were Priestley and Cavendish. It continued to be the orthodox faith until the last quarter of the eighteenth century, when, after the discovery of oxygen, it was overturned by Lavoisier."

#### Refrigeration and its Applications

FOR the first of the series of Research and Development Lectures arranged under the auspices of the British Science Guild and delivered at the Royal Institution, Sir William Bragg, on May 2, took as his subject "Refrigeration". This he pointed out is of great importance to Great Britain, which imports an immense amount of meat, fish, butter and fruit, many hundreds of shiploads of which are received every year. The principles underlying refrigeration are comparatively simple, but their application on a commercial scale has involved much research such as is being carried out at Cambridge, the National Physical Laboratory, East Mall and elsewhere. Historically, the subject of heat and cold goes back to the early days of the Royal Society, and Hooke's views on fluidity are of much interest. In the eighteenth century, the theory of caloric held sway, but it was through the work of Rumford, Davy, Mayer and Joule that it was shown that heat is, in the phrase of Tyndall, a mode of motion, and to-day it can be shown that the molecules of substances are all in motion, the rapidity of which is increased by heat and decreased with cold. All the phenomena of expansion, compression and evaporation, which are utilised in refrigerating machines, are explained by this theory. Throughout the lecture, each step was illustrated by experiments in which billiard balls, bicycle pumps and liquid air played as important a part as thermo-couples and galvanometers. A singularly beautiful demonstration of the formation of vapour and clouds was given by pouring liquid air on to the surface of warm water lying in a large shallow pan. Liquid air was used also to show the alteration in the properties of substances when really cold, rubber becoming brittle and a bell of lead giving a metallic note when cooled in it. Sir William referred to the refrigeration exhibition now being held at the Science Museum, and on behalf of the director of the Museum invited all those in the audience to visit it.

#### Electrical Phenomena at Very Low Temperatures

PROF. J. C. McLENNAN gave the twenty-fifth Kelvin Lecture before the Institution of Electrical Engineers on April 26, taking as his subject "Electrical Phenomena at Very Low Temperatures". In 1823 Faraday succeeded in liquefying chlorine and afterwards succeeded in liquefying many other gases, but he failed to liquefy oxygen, nitrogen and hydrogen as he was unable to obtain the requisite low temperature. At the end of the War, a large stock of helium was available in Toronto, and this gas was successfully liquefied in 1923, a century after Faraday's experiment with chlorine. By evaporating liquid helium and thus reaching an absolute temperature of  $0.7^{\circ}$  K., Keesom of Leyden successfully solidified this element in February 1932. The liquid was subjected to a pressure of 175 atmospheres and

surrounded by rapidly evaporating liquid helium. The reason why liquid oxygen, hydrogen and helium are very good insulators is probably because the electrons are closely bound to the nuclei. In 1911, Kamerlingh Onnes found that the resistance of mercury vanishes suddenly at  $4.2^{\circ}$  K. and that some other metals behave similarly at definite low temperatures. Most metals show no trace of this superconductivity even when great pains are taken to ensure their purity. Certain alloys have been found to become superconductive. This superconductivity can be destroyed by placing them in a magnetic field. The lower the temperature the greater the magnetising force necessary to destroy the superconductivity. By suddenly destroying the magnetic field surrounding a ring of superconductive metal, a current can be set up in it if its temperature be below the transition point. This current is quite independent of the nature of the metal and depends only on the intensity of the original induction. It looks as if the results of low temperature research would throw light on the nature of magnetism.

#### The Restrictive Law of Population

IN his Huxley Memorial Lecture under this title, delivered on May 4, Prof. Johan Hjord, of the University of Oslo, dealt with a subject which exercised a decisive influence upon the thought of Huxley: the question of over-population (London: Macmillan and Co., Ltd. 1s. net). Prof. Hjord assumes that human society can be studied as a historical group of diverse individuals living in a restricted complex environment, and shows that biology has disclosed the many and various factors which influence the vital processes of the individuals comprising a population and determine the quantity and quality of the population as a whole. He defines an optimum population as the minimum number of individuals who can utilise to the full the vital possibilities made available by one or other of these factors. Incidentally, he surveys the fishing and whaling industries as examples, and illustrates his point that the conditions in both depend upon the power of regeneration shown by the stock. In the case of the whale, technical developments have produced a grave disharmony between the reproductive rate and the death rate, and the problem before the industry is that of defining the optimum catch. Restriction of the numbers killed is urgently demanded, but this requires both State intervention and international agreement.

ACCORDING to Prof. Hjord, the ideal of all social endeavour is the maintenance of the population in a state of permanent equilibrium under conditions of life which are optimal. For the achievement of this ideal, society must undertake vast and prolonged biological experimentation. Through biology there has come an emancipation from mental chaos and from the belief that human life is governed by irrational chance. Biology has shown that over-population, which inevitably arises in certain given natural conditions, is not due to a superficial turmoil of moods and sentiment, but to the operation of natural laws. To-day society has both the knowledge

and the power to solve, in its own ways, the problem of population. If there be the possibility of enlargement of the means of subsistence, of renewed expansion, then this should be completely explored; but if such expansion is impossible, then the aim of society must be to ascertain the limits in which an optimum population can enjoy the maximum of liberty. In both tasks the method must be that of the social experiment. Though Prof. Hjort mainly restricts himself to a discussion of the method of research and experiment in its application to social problems, he does not avoid the conclusion that an economically re-united Europe would afford conditions for a new emancipation, for a recovery of the freedom that the War destroyed. For, he holds, this would bring peace, and peace amongst men is not a natural state of things; it does not make itself, but must be made.

#### Representation of Science on Government Commissions

As announced last week in this column, the Postmaster-General is about to set up a committee to consider the development of television, and to advise on the conditions under which any public television service should be provided. It is understood that the personnel of the committee is to consist of representatives of the Post Office, the British Broadcasting Corporation, and the Department of Scientific and Industrial Research. A committee so constituted, presuming that some of the members have practical knowledge of the problems involved in television, would command that measure of public confidence which is necessary if its deliberations are to find general acceptance; and it would be an advance on many Commissions and committees appointed by the Government in this respect. For reasons which it is difficult to understand, there has been a lamentable tendency on the part of Ministers to pass over scientific men in setting up Royal Commissions, committees, and departmental committees, even when matters in which scientific and technical issues are involved.

It is to be hoped that the constitution of the television committee is a sign that the Governmental mind is being quickened in this respect. Time and again, we have urged that no body set up to consider any subject with scientific or technical ramifications can be adequate or complete unless it includes scientific workers or technicians in its personnel. The Parliamentary Science Committee—a body representing the British Science Guild, the Association of Scientific Workers, and a number of learned societies—has also taken up the matter, urging the Prime Minister to insist on his colleagues observing this principle. Some fifteen months ago the Postmaster-General appointed a Post Office Advisory Committee. If this body is to be of real service it will, presumably, have to advise on technical matters such as telephony and telegraphy. Yet no one with scientific or technical qualifications was appointed amongst a numerous membership. There is now a vacancy occasioned by the death of the Hon. Mary Pickford, thus affording an opportunity of rectifying this state of affairs.

#### Scientific Method and Politics

THE first instalment of a tabular analysis of various social and economic systems, in the form of answers to a questionnaire prepared by the Engineers' Study Group on Economics (*NATURE*, 132, 635, Oct. 21, 1933) is to appear in the forthcoming issue of *Progress*, the organ of the Association of Scientific Workers. The Study Group, apart from research investigations, arranges for discussions on questions of the moment, at which those engaged in any branch of scientific work are welcomed. On May 16 Mr. Harold Macmillan, M.P., will address the Group on "Reconstruction". The meeting will be at 7.45 for 8 p.m. at Denison Hall, 296 Vauxhall Bridge Road, Victoria, and Sir Richard Gregory will take the chair. Tickets may be obtained from the honorary secretary of the Group, Col. P. Johnson, Gunnersbury House, Hounslow, Middlesex.

THE interest which scientific workers are beginning to show in social and economic questions is not restricted to Great Britain. In France there are several active groups. The Centre Polytechnicien d'Etudes Economiques (12 rue de Poitiers, Paris; president, M. Gerard Bardet) consists mainly of former students of the Ecole Polytechnique, one of the best-known engineering colleges in France, and is now in its third year of existence. Another, the Centre d'Etudes Economiques de l'Alimentation (39 boulevard de Sebastopol, Paris; president, M. André Roussel) was formed by the fusion of three pre-existing groups drawn from the Ecole Polytechnique, Ecole des Centraux and the Institut Agronomique. Both organisations publish bulletins regularly, giving the results of their studies on economics and production and distribution of foodstuffs.

#### Unemployment and Poverty in India

IN a recent article in the *Karachi Daily Gazette*, Capt. Petavel, formerly lecturer on the poverty problem at the University of Calcutta, strongly advocates the formation of co-operative colonies as a solution of the problems of unemployment and poverty in India. He suggests that the colonies should be open not only to those who have merely their labour to offer, but also to those who would contribute capital, land or equipment. All would be co-operators in their way, and would have a share of the products. The workers' remuneration would be mainly in kind, but part might be in money. This would enable the more ambitious to save, and in time to launch out on any small undertaking they might fancy. If they failed, they could return to the colony, which would thus provide opportunity with security. As the colonies developed, they could adopt a system of 'exchange tickets' redeemable in the produce of the colony. Thus it is claimed purchasing-power would always be commensurate with productive power. People could always get work in the colony, because they would get a ticket to take away what they had produced. To reinforce his argument, the author refers to the Swiss Labour Colony at Witzwil and that at Llano in Louisiana.